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CENTRAL FILE

THE DENTAL CARIES PROBLEM

JOHN HALDI, Ph.D.
Professor of Physiology
Division of Basic Health Sciences
Emory University, Georgia

During the annual National Childrens Dental Health Week the dental profession places particular emphasis on measures for the prevention of dental caries. This disease, frequently referred to as tooth decay, is the most common dental disorder among children. Its daily toll in terms of money and of human suffering is enormous. Once the initial lesion occurs, the only known treatment is to remove the decayed area and fill the prepared cavity with appropriate dental material. Allowed to go unattended it usually progresses and in time teeth may have to be extracted because of extensive damage done by the decay process.

Investigators are trying to discover the mechanisms involved in the initiation of dental caries. Knowledge of the causative factors could provide a rational approach to the problem of prophylaxis and treatment. At present, prophylactic measures are for the most part empirical. The most effective is fluoridation of public drinking water. This procedure was suggested by the low incidence of dental caries in areas where fluoride occurs naturally in the water. Good oral hygiene—in particular brushing the teeth or rinsing the mouth thoroughly with water after eating—may also be helpful in preventing dental caries. Frequent visits to the dentist contribute to the control of the disease by making possible early detection of the carious lesions and prevention of their spreading. Our knowledge ends here as far as preventive measures are concerned.

Dental caries is a difficult and complex problem in which many factors may be involved. Fortunately, it is possible to induce caries experimentally in the teeth of laboratory animals such as the rat and the hamster. Investigators are now able to study the onset and prevention of dental caries under carefully controlled conditions.

Clinical experience of dentists has led them to believe that high consumption of carbohydrate foods, particularly sugar, is one of the causative factors. Only a few experiments have been made in which the relation between caries activity and sugar consumption has been investigated in people under well controlled conditions. Reports of different studies are contradictory.

One of the best controlled studies was conducted over a period of five years (1946-51) in a hospital for mentally retarded patients in Sweden. This revealed that the physical form in which sugar is eaten is more important than the total amount consumed.

One group of patients was given 300 grams of sugar in solution daily with their meals for two years. Sugar consumption amounted to slightly more than 200 pounds per year over and above the sugar in the basal diet of typical Swedish foods. These patients had an average of 0.67 tooth surface that became carious per person per year as compared with 0.30 tooth surface for the patients on the basal control diet. This is an extremely low rate of increase in the incidence of new carious lesions. Patients given approximately the same amount of sugar per day, but allowed to eat a large portion between meals in a sticky form that adhered to the teeth had an average of four new carious surfaces per person per year.

Similar observations have been made in animal experiments. When rats were fed by stomach tube all the constituents of a cariogenic diet except sugar and allowed to eat sugar in the solid form, an appreciable amount of caries was produced. There was practically no caries when the same amount of sugar was consumed in the liquid form. In another experiment the ingestion of a dry whole milk mixture resulted in a relatively large number of carious lesions while caries became almost negligible when the mixture was reconstituted with water to produce a liquid ration equivalent to whole milk.

Recent animal experiments have shown that the cariogenicity of diets is not entirely predictable on the basis of

Dr. Haldi

their sugar content. Natural diets, containing 17% sucrose and resembling the average human dietary were found to be more cariogenic than a synthetic diet containing a large amount of sucrose, namely, 67%. In other experiments two synthetic diets each containing 64% sucrose were found to be markedly different in cariogenic properties. There is evidence that this difference in cariogenicity may have been due partly to a difference in the composition of the salt mixtures added to the two diets. These investigations and many others emphasize the complexity of the dental caries problem. It is a challenge to future research.

Within the limitations of our present knowledge, dental health is fostered by: eating a well-balanced diet containing all nutrients essential to the growth of teeth and their supporting structure, and with restriction of "sticky" sweets in the diet, especially between meals; brushing the teeth properly after eating, or at least rinsing the mouth with water; fluoridation of the community water supply or the topical application of fluoride to the teeth if fluoridation is not possible; and regular visits to the dentist.

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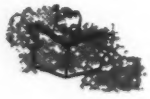
Glances AT NUTRITION RESEARCH

Diet and nutritional status appear closely linked with dental health. Still unclear is the precise relationship between specific nutrients and the ability of teeth to resist decay.

More caries among girls—Percentages of teeth found decayed, missing or filled consistently were higher and number of erupted caries-free teeth were lower among girls than boys of the same ages, 7-8 and 12-13 years in four Norwegian areas. For both, caries rate dropped each year from 1940-41 to 1946 then gradually increased—correlated with environmental changes of war and recovery.

—Milbank Mem. Fund Quart. 35:127 (Apr.) 1957.



Calcium: phosphorus in the diet—With adequate intake of calcium and phosphorus, composition of enamel and dentin of incisor teeth of albino rats were not affected by varying the ratio of these two minerals in the diet. Calcium, phosphorus, magnesium, nitrogen and carbon dioxide content were the same whether the ratio of Ca:P was 1:0.5, 1:1, 1:2 or 1:3.

—J. Nut. 63:57 (Sept.) 1957.

Teeth and diet during wartime—Dental caries decreased among urban, village and rural children in Norway during the war with slow increase afterwards. This was correlated with: retarded eruption of teeth and of growth in height and weight; general increase in mortality; restricted intakes of total calories, fat and carbohydrate, especially sugar and sugar products; increased use of root vegetables and coarse flour by all and of milk and vitamins A and D by pregnant women and pre-school children during the war. There was a slow return to normal diet and health status afterwards.

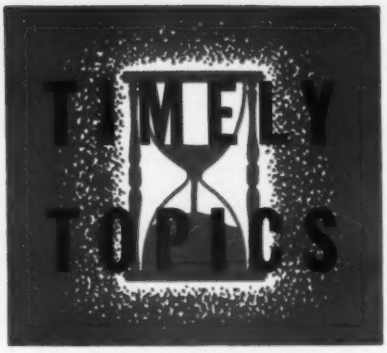
—Milbank Mem. Fund Quart. 35:373 (Oct.) 1957.

Health status and dental caries—Slower growth rate and less activity accompanied a lower dental caries rate in rats fed 67 percent potato starch when compared with those fed 67 percent sucrose.

—British J. Nut. 11:13 (No. 1) 1957.

Caries-producing potentialities of various foodstuffs—Production of acids in dental plaque was studied after ingestion of solid and liquid foods. Milk chocolate produced most acid, followed by toffee, white bread, and dates. Little acid was produced by French-fried potatoes, apples, ice cream and beverages. The amount of acid does not depend solely on carbohydrate content. Variations in food retention were found between different subjects, and at times in the mouth of the same subject. Milk chocolate, biscuits and ice cream gave the highest retention values; lowest values were for white bread, bananas, apples and beverages. For some foods retention on the mucous membranes exceeded that on teeth. All solid foods, except carrots, gave higher retention of carbohydrate than did liquids.

—J. Dent. Res. 36:56-60, 61-67 (Feb.) 1957.



John Haldi has been engaged for a number of years in dental research and is intensely interested in the problem of dental caries. In 1948 he helped reorganize the Department of Physiology, Emory University School of Dentistry, serving as professor and department chairman until 1953. He is now Professor of Physiology, Division of Basic Health Sciences. He is a member of the American Physiological Society, International Association for Dental Research, Federation Dentaire International and other scientific societies.

The United Nations International Children's Fund continues to help provide daily supplemental meals, in cooperation with governments, for over 5,750,000 children and mothers.

Eleven million pounds of surplus milk powder were shipped last year. A recommendation to up the milk ration to Central America was made, based on a FAO survey. Severe malnutrition was found in a large number of children from one to five years of age.

Surveys by the Delaware State Board of Health reveal eating patterns of cleft palate children, in not taking enough milk, citrus fruits and vegetables, are similar to food habits of many children. These children need nourishing meals for normal growth and development—and to undergo the stress of surgery. Their food is especially important due to the relationship of diet to prevention of dental caries and to healthy gums. A nutritionist is now a member of Delaware's orthodontic clinics.

DIETARY PROTEIN AND DENTAL CARIES

By F. J. McClure, Chief, Laboratory of Oral & Biological Chemistry
National Institute of Dental Research, Bethesda, Maryland

Minimum consideration has been given to the possibility that the kind and amount of dietary protein may influence the susceptibility of teeth to development of dental caries. Attention has been focused on the influence of the carbohydrate and mineral components on the development of the disease. Yet, observations on the occurrence of dental caries in primitive or isolated peoples have suggested that abundance of protein in the form of meat in the diet was associated with a low caries rate while abundance of cereals was related with a more extensive occurrence of this disease.

Recent laboratory experiments producing dental caries in rats also suggest that total protein intake and a deficiency of a single amino acid (lysine) in the diet may affect susceptibility to dental caries. It has been shown that diets containing special heat-treated skim milk powders were deficient in lysine, and became responsible for a high incidence of severe dental caries in white rats. This caries was significantly reduced by a dietary supplement of lysine. Refined diets containing zein, a corn protein—naturally lysine-deficient, also became less caries producing with a lysine supplement.

An attempt was made to determine how lysine was effective in reducing dental caries under these experimental conditions. The rat's oral cavity was bypassed in giving lysine by stomach tube and by intraperitoneal injection. Intubated lysine, and to a limited extent injected lysine, reduced dental caries. There was no detectable increase in the lysine of the rats' saliva. This experiment supports the theory that this added lysine acts through extra-oral systemic channels to decrease the rate of caries development.

It is of interest that several reports attest to the importance of lysine in the calcification process. It has been reported that the bones and incisor teeth of rats maintained on lysine-inadequate diets show pathological changes presumably associated with defective tooth formation. More recently, lysine has been found to promote the intestinal absorption of calcium, thereby suggesting a possible role for this amino acid in mineral metabolism.

The importance of the quantity of protein in the diet was noted when severe experimental caries developed on an otherwise adequate diet containing 13 percent casein. When the casein content was increased to 24 percent there was only a limited amount of caries produced.

Certain raw cereals—wheat, corn, oats and millet, or foods prepared from these cereals—when present in large quantities in experimental rat diets, have also caused a high incidence of severe dental caries. A lysine supplement corrected this caries to some extent, but there seemed to be other factors involved in the production of caries by the cereal diets.

In all of these studies the diets were offered to rats of weanling age, at which time the molar teeth are nearly completely erupted and calcified. There is little or no possibility of the diets having an influence on the teeth during the major period of tooth development. It is a significant and an important advantage that in these experiments there was an extensive development of caries on the smooth surfaces, particularly buccal, of the lower molar teeth. This type of caries is prevalent in the human dentition.

DENTAL AUXILIARY DRAMATIZES DENTAL HEALTH FOR PRE-SCHOOL CHILDREN

By Mrs. Richard H. Workman, President-Elect
Auxiliary to Nashville Dental Society

A puppet, resembling Mickey Mouse, has been a successful salesman in Nashville. His customers are pre-school children. His product is dental health. Fact and fancy combine for each child's benefit as a mouse explains how foods can contribute to healthy teeth. The children love it, and we have discovered a visual way to say "Drink your milk," without preachment.

Another group of children listen attentively to the story of the twins—one with good teeth and the other with tooth decay. Up go the felt characters on the flannelgraph as the story unfolds. Every child in the room can soon tell you how to take proper care of his teeth. In a third classroom, you find children with toothbrush in hand, marching and singing a song about a trip to the dentist. What is going on in these classes? It is an experiment in dental health education.

The auxiliary of the Nashville Dental Society has supported dental health educational programs in city and county schools through the purchase and distribution of printed health materials. In 1956 the members of our organization desired to take a more active role in improving children's dental health. The question arose as to how and where we could do an effective job. Was there an area to which we could contribute? The pre-school child seemed to be the answer since there was a need for dental health education at this age level.

To prepare ourselves we set up a workshop with the help of the local school health co-ordinator and state dental hygienist. The first session was spent finding answers to such questions as: how many facts can a pre-school child grasp? how long is his attention span? what are the important facts to stress?

Our presentation must meet the standards of both the educator and the dentist. In our search for materials and ideas, the Dairy Council of Nashville was one of our first resource centers. Their attractively colored food pictures, nutrition charts and posters seemed tailored to our needs. Three techniques stressing the same basic health facts emerged from the workshops. One

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—that the characteristic taste of an orange, or any fruit, is due to the volatile materials it emits as "smell"?

—that dairy research at the University of Wisconsin has developed synthetic skim milk, from casein, purified lactose and milk salts, as a tool for the study of rennet-like enzymes?

—that the South accounts for only a fourth of the U.S. food expenditures, yet nearly a third of our population?

—that Dr. Hillbrunn and others of the University of Pennsylvania report impressive results in controlling the development of cancer cells in white rats through the use of an ovary extract from cows?

—that the American Indian used pine needles, rich in vitamin C, to cure scurvy?

—that they preserve eggs in China by a bacterial action, much the same way as we preserve milk by turning it into cheese?

—that the "better houses" of Jamestown in 1634 served each guest with a mold of butter of individual design?

—that the United States rang up sales last year for over four billion ice cream cones?

—that families with children are today the real market for frozen juices, vegetables and fruits?

THINGS YOU'LL LIKE TO READ

Calcium Metabolism—J. T. Irving. John Wiley and Sons, Inc. N.Y. 1957. $2.75.

Dr. Irving's comprehensive review of what is known about calcium's role and how it functions in the body, is a small and readable book. He outlines the balance experiments on which recommended dietary allowances in this country are based. He believes the ability of calcium to combine with protein to form compounds occurring almost throughout the body is calcium's most significant biological property, accounting for its role in many physiological processes.

Dental Health Education—Frances A. Stoll. Ed. D. Lea & Febiger, Philadelphia, 1957. $4.50.

A reference for public health educators, dentists, dental hygienists and allied professions. The book is broad in scope; detailed in presentation. Part I suggests ways of coordinating dental health education with other health services. Part II gives methods of dental health education in schools. Part III reviews various techniques—audio visual aids, dramatics, lectures and group discussions. Part IV discusses adult dental health and the dentist's role in patient education.

DENTAL AUXILIARY DRAMATIZES DENTAL HEALTH FOR PRE-SCHOOL CHILDREN

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group decided on a puppet show prefaced by an attention getting story. This meant developing a skit and producing a portable stage. Another group found several commercial records that could be adapted for the pre-school child. They combined these with original songs of their own in a child participation skit. A third group put the flannelgraph to effective use. Felt figures illustrate what happens when teeth are not cared for properly.

Using our own children and others in the neighborhood, we began test runs. The first check-point of "child-appeal" passed with flying colors. Then, knowing that nursery school and kindergarten teachers could most effectively evaluate our efforts, we sought the advice of the Nashville Council of Education for Children Under Six. They viewed our work and were enthusiastic about the program. After getting their approval, we could then present our material knowing it had sound educational value.

One member contacts teachers and arranges a convenient time for the presentation. Other auxiliary members take the skits to the groups and they find the children and teachers a receptive audience. The suggestions of the teachers are recorded after each appearance so as to make changes and improvements.

At the Tennessee Dental Convention last May, we had the opportunity to explain our program and to publicly offer help to other auxiliaries in the state in setting up similar programs through the use of mimeograph copies of our materials.

There is still a need for more workshops of our own. Through them we can take advantage of what we have learned in the past. We will experiment with other methods and techniques to help the pre-school child to hear, see and learn the basic concepts of dental hygiene.